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$$\frac{\triangle m}{\triangle m+1} = \sqrt{\left(1-\frac{1}{m^2}\right)} \ldots . (4).$$

II. Solution by G. B. M. ZERR, A. M., Ph. D., Vice President and Professor of Mathematics in the Texarkana College, Texarkana, Arkansas.

Let p be the excess of pressure, on the assumption that the external pressure is costant.

Let u=original volume, then when the sphere is n times its original volume, the work done in this electrification must be

$$p(n-1)u, \text{ (see } \textit{Minchin's Statics}).$$

Let v be the potential, Q the charge of this electrification, r=radius of sphere, σ=electrical density.

$\therefore$ energy of electrification $=\frac{1}{2}vQ$. But $v=\frac{Q}{r}$ and $Q=4\pi r^2\sigma$.

$\therefore p(n-1)u=\frac{1}{2}\frac{Q^2}{r}=8\pi^2 r^3\sigma^2$. But $\frac{4}{3}\pi r^3=nu$.

$\therefore p(n-1)u=6n\pi\sigma^2 u$.

$\therefore p(n-1)=6n\pi\sigma^2$.

Similarly, when the sphere becomes $(m+1)$ times its original size we get, if σ_1 is the density, $pm=6(m+1)\pi\sigma_1^2$.

$$\therefore \frac{\sigma}{\sigma_1}=\sqrt{\frac{(m+1)(n-1)}{mn}}=\sqrt{\frac{m^2-1}{m^2}} \text{ if } n=m.$$

27. Proposed by G. B. M. ZERR, A. M., Ph. D., Vice President and Professor of Mathematics in the Texarkana College, Texarkana, Arkansas.

One thousand balls, each having a mass of 10 grams, and each moving with a velocity of 10 kilometers per second, are confined in a certain space with elastic walls. Into the same space are now introduced one thousand balls each of 1000 grams mass, and moving with a velocity each of 10 kilometers per second; collisions take place, and finally, after a number of encounters, the average kinetic energy of each of the two thousand balls is the same. Show that this is 5.75(10)11 in the centimeter-gram-system.

Solution by O. W. ANTHONY, Professor of Mathematics and Astronomy, New Windsor College, New Windsor, Maryland and the PROPOSER.

By Avogadro's hypothesis and kinetic theory, if M, M_1 are the masses and V, V_1 the velocities of two balls, then $\frac{1}{2}MV^2$ and $\frac{1}{2}M_1V_1^2$ are their respective kinetic energies. As the average kinetic energy of each ball is equal, we get $\frac{1}{2}MV^2=\frac{1}{2}M_1V_1^2$.

$\therefore$ The average kinetic energy $=\frac{1}{2}(\frac{1}{2}MV^2+\frac{1}{2}M_1V_1^2)=E$.

$\therefore E=\frac{1}{4}(MV^2+M_1V_1^2)$.

Let $V=V_1$, then $E=\frac{1}{4}(M+M_1)V^2$.

V=10 kilometers$=10^6$ centimeters.

M=10 grams, M_1=100 grams.

$\therefore E=\frac{1}{4}(10+100)10^{12}=\frac{11}{4}\times 10^{13}=2.75\times 10^{13}=2.75(10)^{13}$.

Also solved by F. P. MATZ.